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SHORING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This a continuation of applications of U.S. Patent Application No. 09/543,442, filed April 5, 2000 and U.S. Patent Application No. 10/414,710 filed April 15, 2003.

TECHNICAL FIELD

This invention discloses a shoring system for use in trenches, pits and other open excavations.

BACKGROUND OF THE INVENTION

Shoring systems are used to prevent walls of open excavations to cave in and secure the safety of working place. This invention relates to a particular type of shoring devices called 'Slide Rail Shoring System' consisting of rails, large shoring panels and horizontal struts or strutting assemblies. Each rail has laterally, on either side, one or more guides for sliding shoring panels. According to alignment of lateral guides on either side of the rail two distinct types of rails are specified, linear rail and corner rail. Panels sliding on either side of a linear rail follow same alignment forming conjointly a straight shoring wall. Panels sliding within one side of a corner rail are perpendicular to panels sliding within other side, outlining a 90 degrees turn of shoring wall. The linear rail has a frontal guide relative to interior of excavation, for sliding at least one horizontal strut or a strutting assembly. Linear rails are used in pairs, which are spaced apart along the excavation. Linear rails of a pair of rails are held vertically parallel and pressed against either wall of excavation by at least one horizontal strut or strutting assembly. Shoring panels slide within respective guides of adjacent linear rails of pair of rails creating thereby a stepped shoring wall. The outermost and innermost steps of the shoring wall relative to interior of excavation are called respectively outer wall and inner wall, so the lateral guides on either side of the rail. Corner rails are used on each corner of a rectangular shaped open excavation.

Previous slide rail shoring systems as disclosed in U.S. Pat. Nos. 3,910,053 and 4,657,442 (Krings), use rails having laterally individual formlocking channel guides of C-shaped section that interlock the guide edge of T-shaped section provided alongside each lateral end of shoring

panels. This type of interlocking highly concentrates the stresses in the contact between rail and panel engendering damages in both rail and panels, strongly limiting the successful use of this shoring device.

The US Pat. Nos. 5,310,289 and 5,503,504 (Hess et al.), disclose a rail having laterally on either side only one channel guide for both inner and outer walls, created respectively by an inner panel and an outer panel named according to the shoring wall they create. The channel guide has a U-shape and has on backside of the guide channel a square bar to interlock the outer panel within the rail. The guide edge of inner panel is not interlocked within rail and slides freely within presenting thereby a risk to kick in the trench when adjacent rails are not aplomb, what becomes a serious safety issue when depth of excavation is over 20 ft. deep. The outer and inner panels have unequal design and are not interchangeable raising inventory concerns in term of panel inventory, their handling and administration as well as various inconveniences during installation and removal of shoring system in job site.

U.S. Pat. Nos. 6,164,874 (May) discloses a slide rail shoring system as improvement or ulterior development of those published in U.S. Pat. Nos. 5,310,289 (Hess) and European Pat. Nos. 0 100 083 (May). Likewise, this shoring system uses two unequal types of shoring panels, an outer panel, which slides formlockingly within rail, and an inner panel, which slides freely within rail. This slide rail shoring system manifests same functionality and drawbacks as per those discussed previously above.

BRIEF SUMMARY OF THE INVENTION

This invention relates to a slide rail shoring system including rails, large shoring panels and strutting assemblies as described above. Each rail has lengthwise, laterally on either side, one or more U-shaped guides, each of them provided lengthwise with a locking bar to interlock shoring panels sliding within. The outer guide runs all along the rail, while the inner guide runs quasi halfway from the bottom of rail simplifying the insertion of shoring panels within inner guide and reducing the weight of rail as well. Each linear rail has lengthwise, frontally outward towards interior of excavation, one edge guide to engage cooperatively into a C-shaped guide provided on either side of each strutting assembly. Usually, the corner rails are not provided with a frontal guide because there is little or no need for them to be supported by strutting assembly against walls of excavation. However, one variation of corner rail having a frontal guide is shown herewith as well.

In one variation, the lateral guides on opposite sides of corner rail are oriented perpendicularly to each other for creating perpendicular shoring walls. This variation of corner rail is used for shoring pits of rectangular shape.

In another variation, the lateral guides on either side of the corner rail form an angle of 120 degrees with each other, so the panels and shoring walls on either side of the corner rail. This variation of corner rail is used for shoring pits of hexagonal shape. Yet other variations of corner rails for shoring polygonal shaped pits of five or more corners are revealed. These variations find enormous interest when it comes to shoring of big sized pits because it eliminates the need of long and cumbersome strutting assemblies between opposite linear rails.

The shoring panels have identical design. Each panel has laterally, on either end, one edge guide to be received cooperatively within any of lateral guides of the rail. Each edge guide of panel has lengthwise on backside relative to interior of excavation, a locking bar to interlock within guide of rail.

The strutting assembly has one horizontal spreader fastened and two vertical members. Each vertical member is provided with a C-shaped guide that encompasses the frontal edge guide of linear rail to slide formlockingly over it. Further, each vertical member has on upper and lower ends one or more rollers to ease the displacement of strutting assembly along linear rail. In a modified variation, the upper and lower ends of each vertical member are also provided with fastening flanges so that vertical extension members could be used to assemble together two strutting assemblies usually needed in shoring of deep excavations.

As described above, the intent of present invention is to provide a shoring system that uses same type of shoring panel for the outer and inner shoring walls, while reduces the friction and stresses in the contacts between components. Another subject of this invention is to increase the safety by interlocking shoring panels within both outer and inner guides of the rail, while providing specific features for the panels such as accessing the guides of the rail by just swinging within. Yet, a subject of this invention is to reduce the weight of rail by adopting two different combinations of structural shapes for upper part and the lower part of the rail resulting in an easier installation and removal of panels of inner shoring wall as well. An important aspect of present invention is the use of common structural shapes allowing to lighten the components, ease the manufacturing process and provide better strength.

Another subject of present invention is to present a modulable strutting assembly able to adapt various technical specifications or configurations and provide a big pipe culvert.

The new features considered as characteristic for the invention are set forth in the appended claims. Other advantages of invention are to be appreciated in view of the following description and drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is a top view of shoring system including rails, shoring panels and strutting assembly applied in a pit of rectangular shape.

FIG. 2 is a top view of shoring system including rails and shoring panels applied in a pit of hexagonal shape.

FIG. 3 is a sectional view of a trench showing two linear rails held apart by a strutting assembly.

FIG. 4 is a sectional view taken along the line I-I of the FIG. 3, showing the cross section of the upper section of linear rail.

FIG. 5 is a sectional view taken along the line II-II of the FIG. 3, showing the cross section of the lower section of linear rail.

FIG. 6 is a front view of linear rail.

FIG. 7 is a side view of linear rail.

FIG. 8 is a three-dimensional view of a corner rail.

FIG. 9 is a sectional view taken along the plan III-III of FIG. 8, showing the cross section of the upper section of a corner rail.

FIG. 10 is a sectional view taken along the plan IV-IV of FIG. 8, showing the cross section of the lower section of a corner rail.

FIG. 11 is a schematic, top, fragmentary, sectional view of a variation of corner rail for shoring pits of hexagonal shape.

FIG. 12 is a schematic, top, fragmentary, sectional view a corner rail having a frontal edge guide for sliding strutting assembly.

FIG. 13 is a schematic, top, fragmentary, sectional view of a variation of upper section of corner rails.

FIG. 14 is a schematic, top, fragmentary, sectional view of a linear rail having laterally, on opposite sides, only one guide for sliding shoring panels.

FIG. 15 is a schematic, top, fragmentary, sectional view of a corner rail having laterally, on opposite sides, only one guide for sliding shoring panels.

FIG. 16 is a three-dimensional view of the strutting assembly.

FIG. 17 is a lateral view of two strutting assemblies connected together by vertical extension members.

FIG. 18 is a three dimensional view of shoring panel showing the edge guides.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings where like numerals indicate like elements, various embodiments of present invention are illustrated.

FIG. 1 shows a top view of an assembled shoring system in a rectangular shaped pit including linear rails **1A**, **1B**, corner rails **2A**, **2B**, **2C**, **2D**, several shoring panels like **3A**, **3B**, **3C**, **3D**, **3E**, **3F** and a strutting assembly **4**. Linear rails **1A** and **1B** are arranged on either side of the pit and held oppositely against each other by the strutting assembly **4**. Corner rails **2A**, **2B**, **2C** and **2D** are arranged respectively on each corner of the pit. Shoring panels **3A**, **3C**, **3E** form an outer shoring wall relative to interior of the pit while panels **3B**, **3D**, **3F** form an inner shoring wall. Panels **3A** and **3C** form a straight shoring wall when sliding on opposite sides of liner rail **1A**, while panels **3A** and **3E** outline a 90 degrees turn of shoring wall when sliding on opposite sides of corner rail **2B**

FIG. 2 shows a top view of an assembled shoring system in a pit of hexagonal shape illustrating several corner rails like **2A**, **2B**, **2C**, outer shoring wall formed by panels like **3A**, **3C** and inner shoring wall formed by panels like **3B**, **3D**. Shoring walls outline 120 degrees turn on either side of each corner rail.

FIG. 3 illustrates linear rails **1A** and **1B** located on either side of an excavation such as trench or pit, supported by the strutting assembly **4**. Each linear rail has laterally, on either side, an outer guide **5** and an inner guide **6** relative to interior of trench, for sliding shoring panels to form respectively an outer shoring wall and an inner shoring wall. The outer guide **5** runs along entire length of linear rail while the inner guide **6** runs quasi halfway from the bottom up. Therefore, in term of structural components, the linear rail has lengthwise an lower section defined by the length of inner guide **6** and an upper section defined as complementary to lower section. The lower section usually represents, but not limited, 30 to 75% of total length of linear rail.

As shown in FIG. 4 and FIG. 5, the linear rail has a back flange 7 to press against the wall of excavation, a narrower front flange 9, two identical lateral flanges 8A, 8B held parallel to each other and spaced apart at distance comparable to but inferior than width of front flange 9 and an intermediary flange 14 parallel to back flange 7 and front flange 9. In the upper section of linear rail, FIG. 4, lateral flanges **8A** and **8B** are welded perpendicularly onto back flange **7** and front flange **9**. In the lower section of linear rail, FIG. 5, lateral flanges **8A**, **8B** are narrower than at upper section and welded perpendicularly onto back flange **7** and intermediary flange **14**. The front flange **9** remains parallel to back flange 7 and join intermediary flange **14** via two or more strips **13A**, **13B**, **13C**. The outer side of each strip **13A** and **13B** are within alignment of outer

side of each respective lateral flange **8A** and **8B**. Thus, the extent portions of front flange **9** on either side of lateral flanges **8A**, **8B** and strips **13A**, **13B**, shape an edge guide to be encompassed by the C-shaped guides provided in strutting assembly. The back flange **7** and intermediary flange **14** project symmetrically outward of lateral flanges **8A** and **8B** shaping a channel structure comprising opposite sides. Each opposing side includes preferably an U-shaped member **10A** or a rectangular tube **10B** welded lengthwise respectively onto lateral flanges **8A** and **8B** at distance quasi equal between back flange 7 and intermediary flange **14**. The U-shaped member **10A** may be a partial or half section of a rectangular structural tube cut longitudinally on either side or formed by other means such as bending a flat bar or by joining (e.g. welding) flat bars. The U-shaped member **10A** the back flange **7** and lateral flange **8A** form the outer guide for sliding shoring panel **3**; the U-shaped member **10A**, intermediary flange **14** and lateral flange **8A** form the inner guide for sliding shoring panel **3B**. Locking bars **11A**, **11B**, of round or rectangular section, are welded inward quasi flush symmetrically on either lip of the back flange 7, so that panel **3** interlocks within outer guide but can access it by swinging. Similarly, locking bars **12A**, **12B** are respectively welded onto front side of each U-shaped member **10A** or rectangular tube **10B**, flush to small side, to interlock panels sliding within inner guide.

As shown in FIG. 6, the front flange **9** of linear rail is provided with several holes **16** for inserting stopping pins, not shown, to keep strutting assembly in various positions relative to linear rail. A pressing plate **15** is fastened on top of linear rail to prevent damages when pushing it down during installation in the ground. FIG. 7 shows that intermediary flange **14** runs halfway or slightly more from the bottom up of linear rail easing the insertion of panels within inner guide **6**. Likewise, for same purposes, locking bars **11** and **12** could be partial relative to entire length of respectively outer guide **5** and inner guide **6**. The front flange **9** could be slightly shorter than entire length of linear rail and so the strip **13** comparing to intermediary flange **14**.

FIG. 8 shows a three-dimensional view of a corner rail as viewed frontally from interior of excavation and slightly above it, depicting two opposing sides comprising respectively the outer guides **18A**, **18B** running along entire length of rail and inner guides **19A**, **19B** running partially from the bottom up. A pressing plate **17** is fastened on the top to prevent damages when pushing the corner rail down into the ground. As shown in FIG. 9 and FIG. 10, the upper and lower sections of corner rail have essentially the same components, consisting basically of a back flange **20** to press against the wall of excavation and two structural channels **21A**, **21B**. The structural channels **21A** and **21B** are oppositely held with their respective flanges looking outward. The respective webs of structural channels **21A**, **22B** and back flange **20** are joined together to shape an isosceles triangle whose vertex angle α, is, but not limited, 90 degrees. Additional reinforcing/redundant plate stiffeners of triangular shape, not shown, may be applied to further secure the components together. Each opposite side includes preferably a U-shaped

member **22A** or a rectangular tube **22B** welded at distance quasi equal from respective flanges of each structural channel **21A**, **21B** forming thereby the outer guide and inner guide for sliding respectively the shoring panels **3A** and **3B**. For the upper section of corner rail, the flange of each structural channels **21A**, **21B** farthest from the back flange **20** is cut almost flush to the web easing the insertion of panels within inner guide. For the lower section of corner rail, a reinforcing/redundant flange **25** may be welded between flanges of structural channels **21A**, **21B** farthest from back flange **20**. Locking bars **23A** and **23B** of round or rectangular section are fastened inward quasi flush onto each back flange of structural channels **21A**, **21B**. Thus, panels slide interlocked within outer guide but can access it by swinging. Similarly, a locking bar **24A** is welded onto each U-shaped member **22A**, flush to narrow side and interior to inner guide, to interlock shoring panels sliding within.

As shown in FIG. 11 the same structural components of corner rail as those presented above, could be used for making variations of corner rails for use in polygonal shaped pits. By just modifying the value of vertex angle α from 90 degrees to 60, 45, 30 or other, corner rails for shoring pits of respectively pentagonal, hexagonal, octagonal shape or other could be obtained.

In another variation as shown in FIG.12, the corner rail is provided with an edge guide formed by a structural channel **27** and a guide flange **28** so that a strutting assembly could slide between oppositely held corner rails.

A complex variation of a corner rail having the lower section same as shown in FIG. 10 but the upper section modified is shown in FIG. 13. The upper section includes a back flange **20** and a narrower flange **27** distantly joined by intermediary of two structural angles **26A** and **26B** held oppositely outward inside out, to form an isosceles trapezoid. The angle α between oblique sides of trapezoid is, but not limited, 90 degrees or equal to vertex angle α of lower section of corner rail. The cross section of structural angles **26A**, **26B** fits within cross section of respective structural channels **21A**, **21B** of lower section so that both sections are joined together to form the entire corner rail. Each structural angle **26A** has the U-shaped member **22A** to form the outer guide for sliding the panel **3**, and the locking bars **23A** weld inward onto the lip of free leg of structural angle **26A** to interlock panels sliding within outer guide.

Other trivial variations of corner rails may be obtained. An example (not illustrated but with reference FIG. 9 and FIG. 10), could be the introduction of a redundant flange up front the back flange **20**, between webs of structural channels **21A**, **22B** spacing them apart and forming an isosceles trapezoid preserving all other components, features and functions of corner rail, as discussed above.

Variations of linear and corner rails for shoring shallow excavations are shown in FIG. 14 and FIG. 15. On both cases, the rails have opposite sides, each opposite side including only one guide for sliding panels **3** and are subsequently named mono-guide rails. As shown in FIG. 14,

the mono-guide linear rail uses basically most of the components of linear rail discussed previously; the particularity resides on the fact that lateral guides on either side are shaped by the back flange **7**, intermediary flange **14** and lateral flanges **8A** and **8B**. As shown in FIG. 15 the mono-guide corner rail uses an angle **29** to join lateral structural angles **26A** and **26B** and a reinforcing flange **30** on front side of it.

As shown in FIG. 16, the strutting assembly consists of one horizontal spreader **31** and two vertical members **32A**, **32B** mounted on either side of the spreader **31** by bolts, not shown, via contact flanges **40A**, **40B**. Each vertical member **32A**, **32B**, consists of two lateral plates **33A**, **33B** held parallel by an upper plate **34A** and lower plate **34B**, a supporting plate **36** and an inner plate **35**. The lateral plates **33A** and **33B** project outward past the upper and lower plates **33A**, **33B** and inner plate **35**. In one variation, each free lip of lateral plates **33A**, **33B** are bent perpendicularly towards each other to shape a guide of C-shaped section with inner plate **35**. In another variation, each plate **33A**, **33B**, not bent, has a strip **41** of round or rectangular section weld inward flush onto respective lip to shape the C-shaped guide. The C-shaped guide of each vertical member **32A**, **32B** encompasses the edge guide of the linear rail and slide interlocked over it. The lateral plates **33A**, **33B** are provided with holes, not shown, where axles **38A** and **38B** are fasten so that at least one upper roller **37A** and one lower roller **37B** could be mounted to ease mobility of strutting assembly along the linear rail. The outermost line of contact over circumference of rollers **37A**, **37B** is past the inner plate **35** and plates **34A**, **34B**.

As shown in FIG. 17, two strutting assemblies are assembled together using vertical extension struts **43A**, **43B** provided with flanges **44A**, **44B** and connect onto lower plate **34A**, **34B** via bolts, not shown. Various lengths of vertical extension struts **43A**, **43A** may be selected to comply with required specifications of excavation.

The shoring panel **3** as shown in FIG. 18, has laterally on either end, a guide edge **45A**, **45B** of U-shape or a rectangular tube, each of them provided on the back side relative to interior of excavation, with respective locking bars **46A** and **46B** of round or rectangular section. In one variation, the locking bar **46B** is straight and flush to the narrow side of guide edge **45B**. In another variation, the locking bar **46A** is slightly bent so that either end is flush to narrow side of guide edge **45A** while the center is inwardly offset up to 0.5" to 1", but not limited. Guide edge **45A**, **45B** may be total or partial relative to height of shoring panel **3**. By preference, locking bars 46A, 46B are partial relative to guide edge **45A**, **45B** but could be total as well.